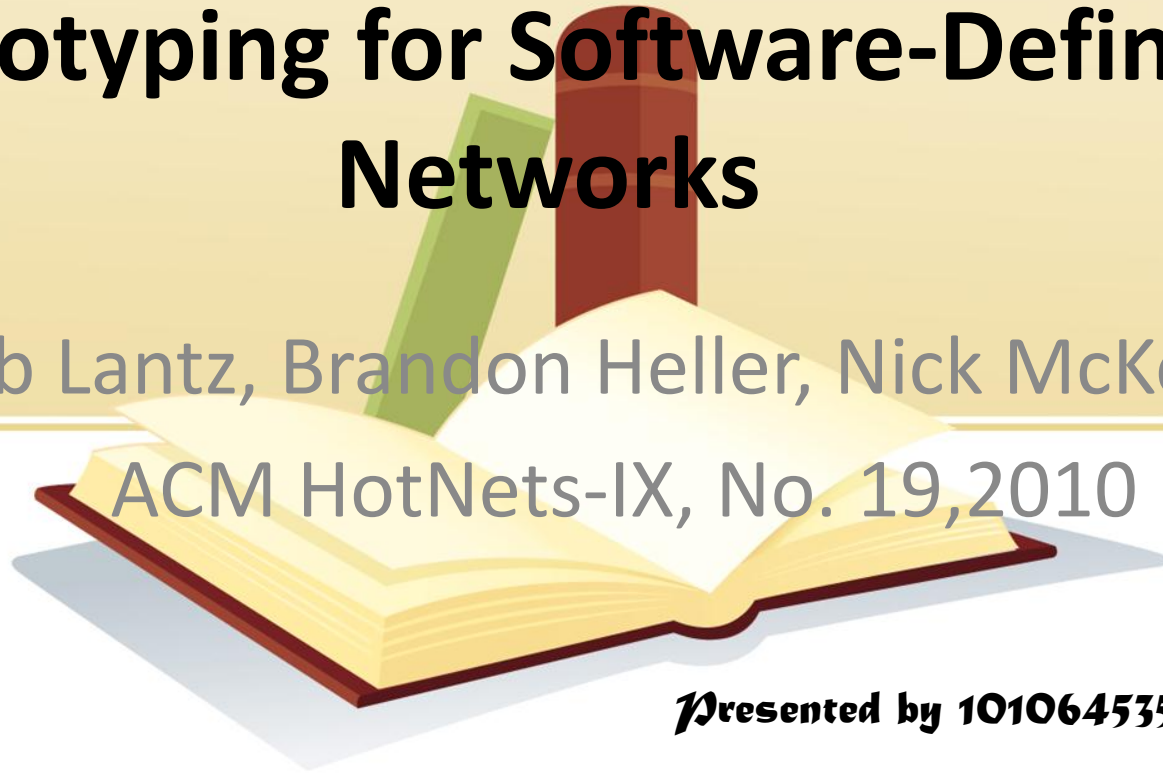


A Network in a Laptop: Rapid Prototyping for Software-Defined Networks

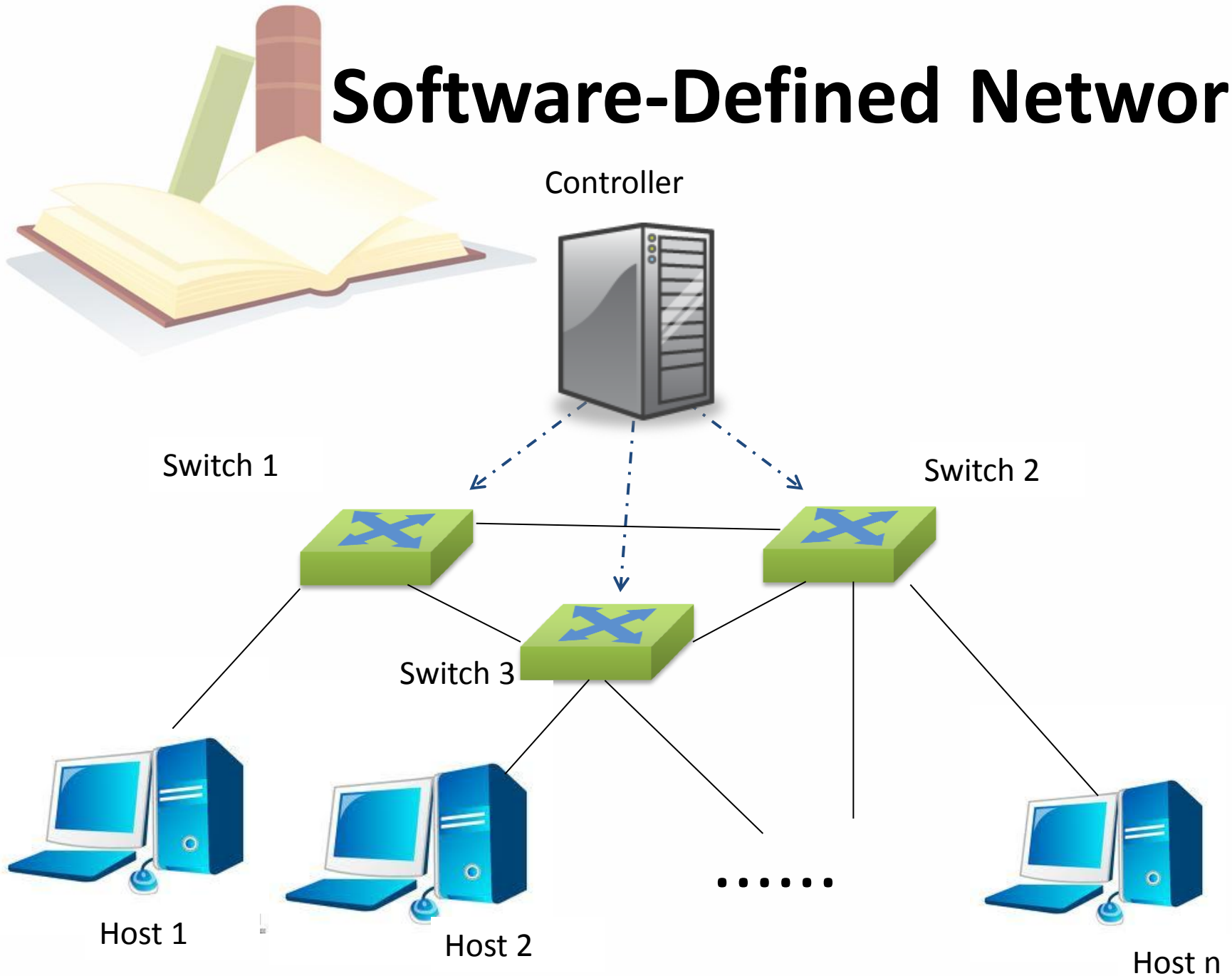
Bob Lantz, Brandon Heller, Nick McKeown

ACM HotNets-IX, No. 19, 2010



Presented by 101064535 鄭如意

Software-Defined Network



Motivation



I have a new
idea about SDN

Paper deadline approaching

No hardware



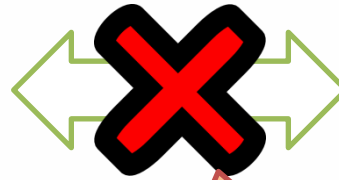
Motivation

Same code can't be
deployed in real network

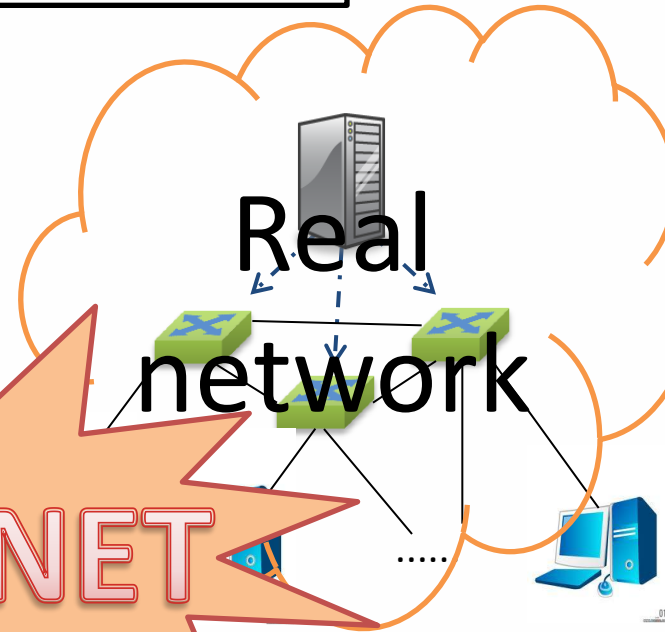
OPNET[®]
Making Networks and Applications Perform™



NS2



Real
network

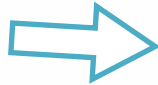


MININET

Motivation



VM



VM switch

⋮

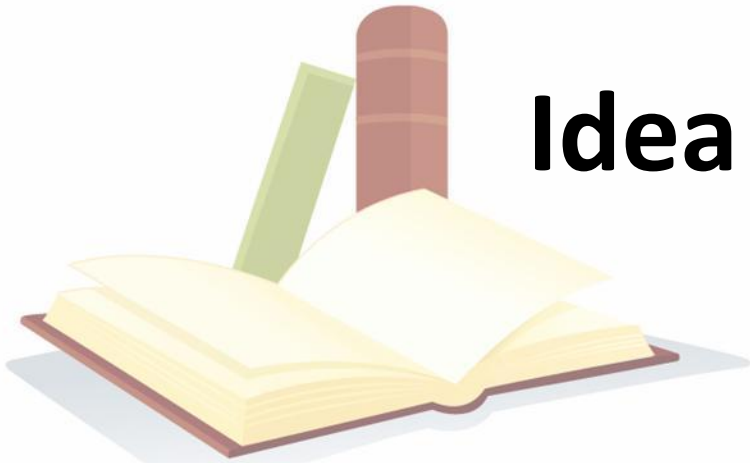
VM host

VMs are too heavy weights

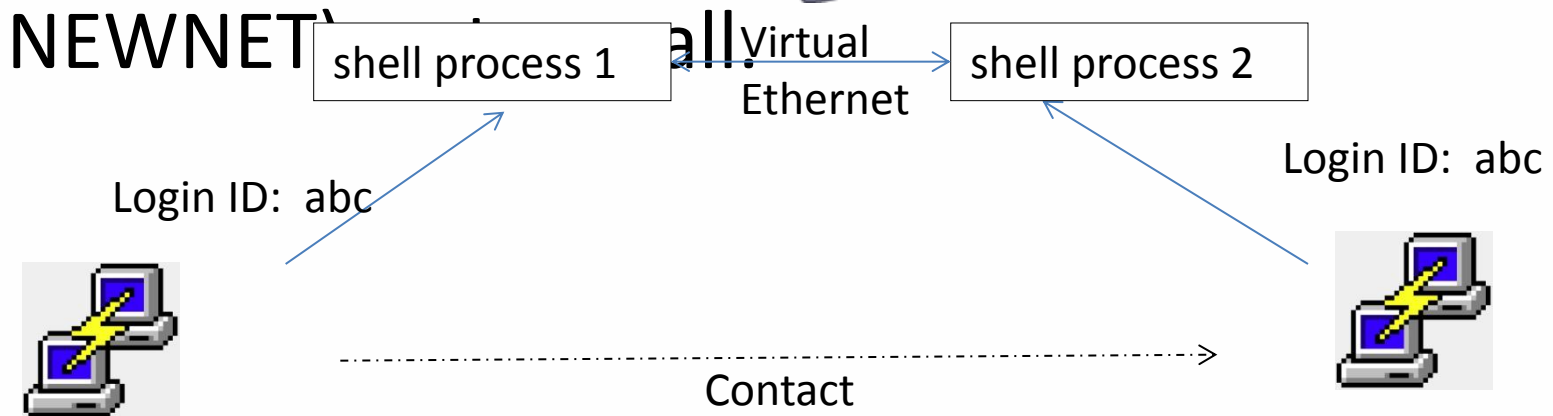


MININET

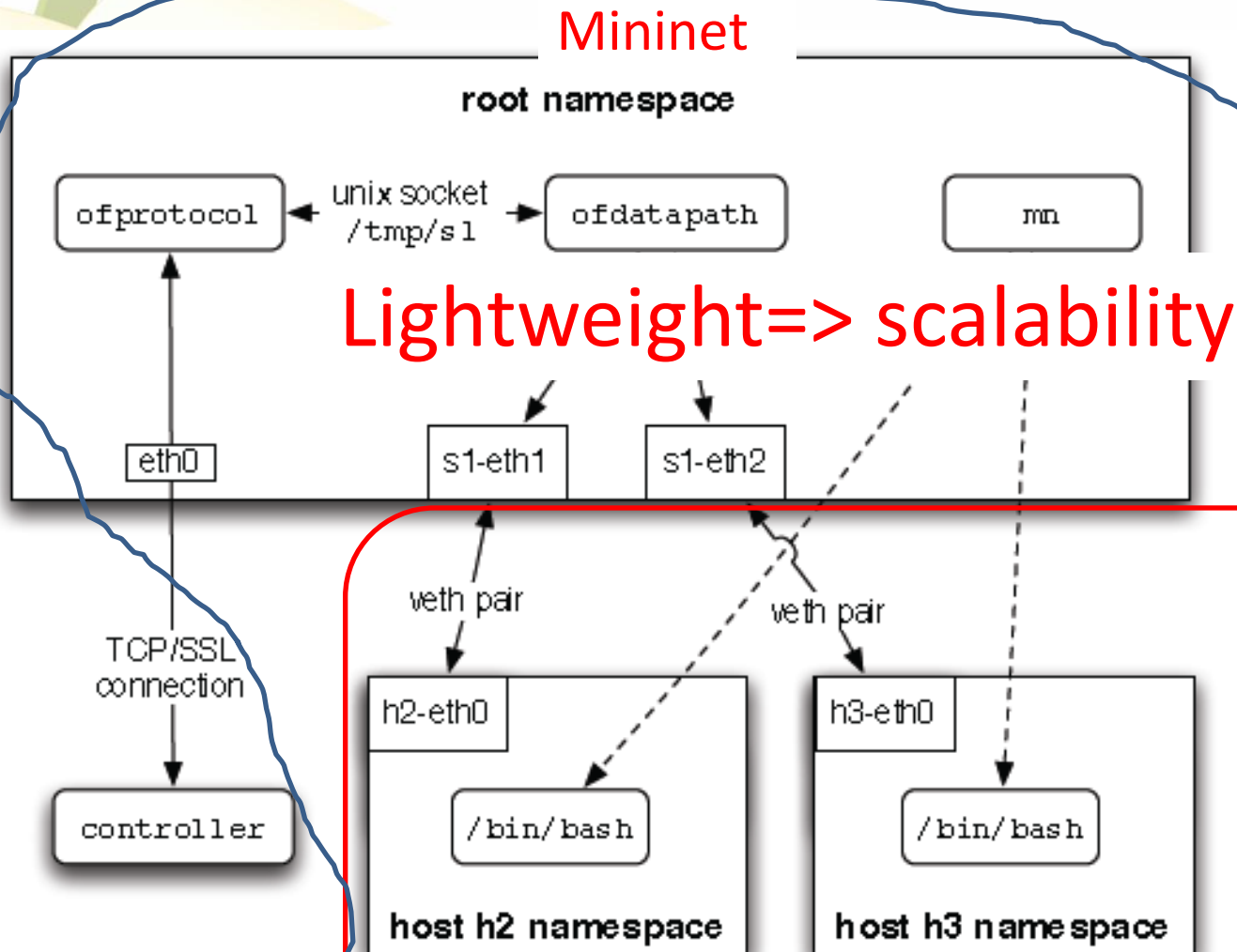
Idea of Mininet



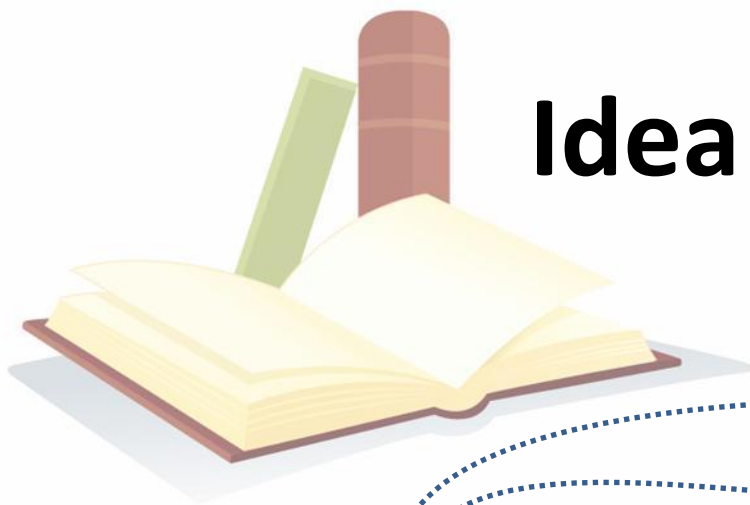
- Environment: Linux
- Hosts: A host in Mininet is simply a **shell process** (e.g. bash) running into its **own network namespace** via the `unshare(CLONE_NEWNET)`



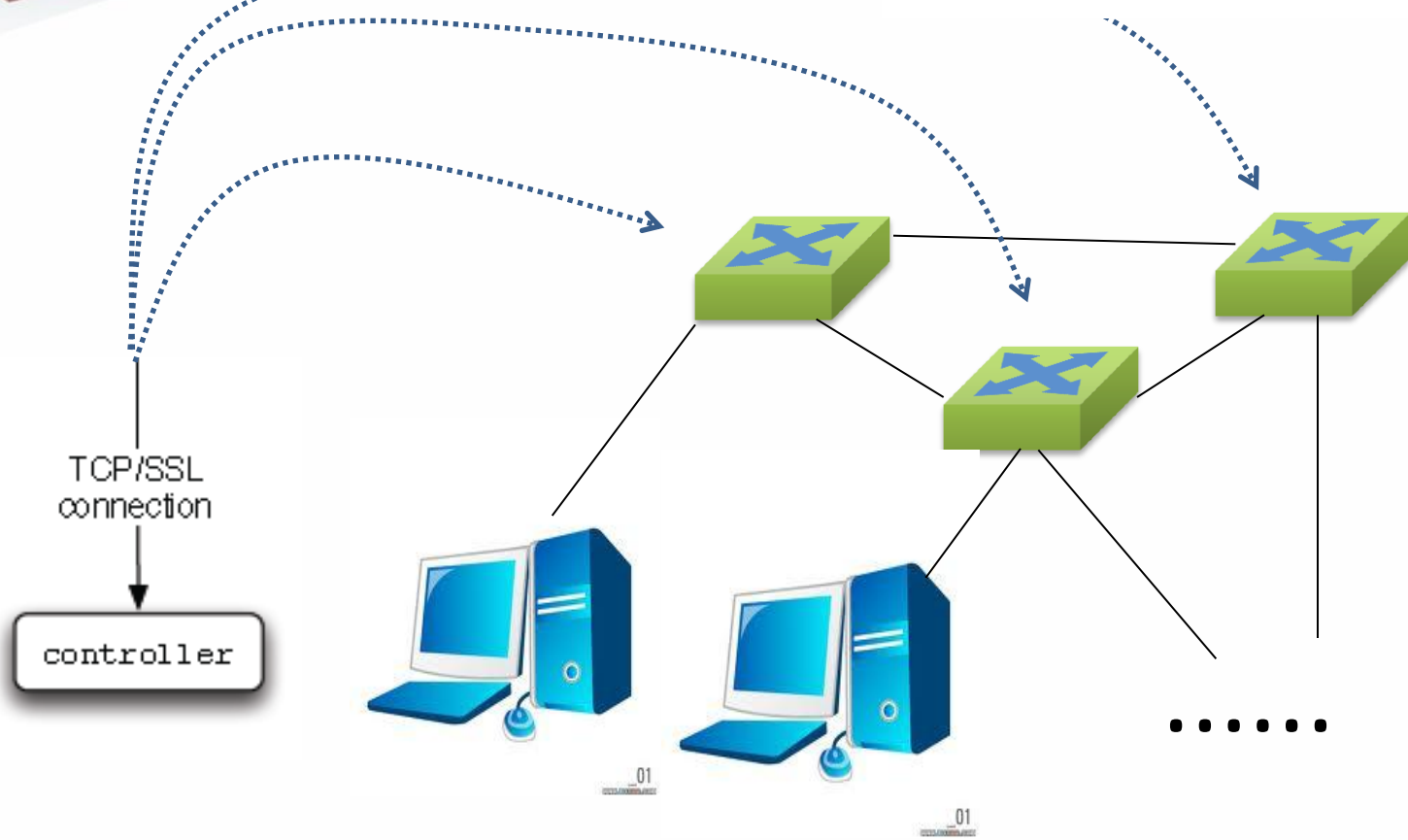
Idea of Mininet



Idea of Mininet



Deployment



Mininet workflow

Step 3: Control the behavior between hosts

Command line

```
mininet> Host 2 ping Host 1
```

API-- MiniEdit

Python API for
define some
script

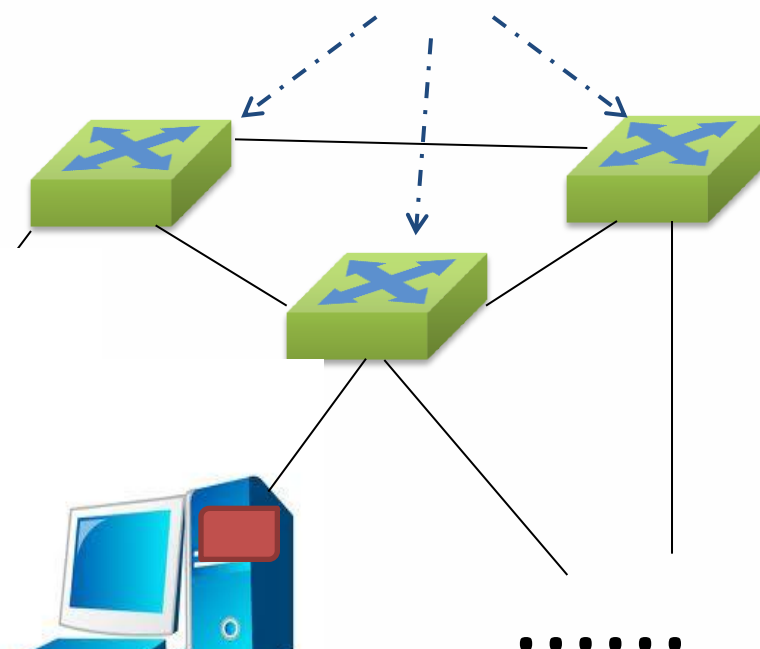
Interactive



Host 1



Host 2



Monitor Interface



Mininet

Hosts	Switches	Controllers	Graph	Ping	Iperf	Interrupt	Clear
h1	h2	h3	h4				
15.6 MBytes Mbits/sec	131	14.5 MBytes Mbits/sec	122	13.7 MBytes Mbits/sec	115	11.7 MBytes Mbits/sec	98.1
h5	h6	h7	h8				
13.7 MBytes Mbits/sec	115	14.4 MBytes Mbits/sec	121	15.0 MBytes Mbits/sec	126	12.2 MBytes Mbits/sec	103
h9	h10	h11	h12				
14.8 MBytes Mbits/sec	124	13.9 MBytes Mbits/sec	116	15.3 MBytes Mbits/sec	129	10.8 MBytes Mbits/sec	90.4
h13	h14	h15	h16				
14.5 MBytes Mbits/sec	121	16.8 MBytes Mbits/sec	141	14.5 MBytes Mbits/sec	122	12.2 MBytes Mbits/sec	103



Performance

S (Switches)	User(Mbps)	Kernel(Mbps)
1	445	2120
10	49.9	940
20	25.7	573
40	12.6	315
60	6.2	267
80	4.15	217
100	2.96	167

Performance



Topology	Host	switch	Setup(s)	Stop(s)	Mem(MB)
Minimal	2	1	1.0	0.5	6
Linear(100)	100	100	70.7	70.0	112
VL2(4, 4)	80	10	31.7	14.9	73
FatTree(4)	16	20	17.2	22.3	66
FatTree(6)	54	45	54.3	56.3	102
Mesh(10, 10)	40	100	82.3	92.9	152
Tree(4 ⁴)	256	85	168.4	83.9	233
Tree(16 ²)	256	17	139.8	39.3	212
Tree(32 ²)	1024	33	817.8	163.6	492



Attribute of Mininet

- Advantage:
 - Interactive
 - Sharing
 - Deployment
- Disadvantage:
 - $O(n)$ linear lookup for software tables
 - Host cannot be migrated live like VMs.

Conculsion



- Mininet is a system for rapidly prototyping large network on the constrained resources of a single laptop.
- <http://mininet.org/>